Synopsis of Proposed Research Work Entitled

"On some computational methods of fractional partial differential equations with dynamically varying conditions and its applications"

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"On some computational methods of Fractional Partial Differential Equation with Dynamically varying conditions and its applications"

1) INTRODUCTION :-

The information on Partial Differential Equation is valuable for comprehension the subjects viz. Fluid mechanics and heat wave as well as study of soil moisture diffusion, stochastic procedure, population growth, traffic stream, aerodynamics. The investigation of Partial differential conditions has become essential with amazing advances innovation made in Science and engineering. Today with the coming of rapid super pcs, calculation has become a focal apparatus of logical advancement. For taking various such condition we utilize a few numerical strategies and programs. We realize that framework delicate by partial differential equations are compound along these lines it is hard to get simply systematic solution.

Fractional calculus:Review

There are three kinds of fractional differential equations

Elliptic,

Parabolic,

Hyperbolic

Consider the general second order partial differential equation proposed by Forsythe and Wasow (1967)

$$A\frac{6^2M}{6s^2} + B\frac{6^2M}{6s6y} + C\frac{6^2M}{6y^2} + D\frac{6M}{6s} + E\frac{6M}{6y} + FW + G(x, y) = 0$$

In two independent variables x, y here the coefficients A,B,C,D,E,F are functions of x and y. the numerical character of the PDE relies on the coefficient A,B and C. the PDE at the point (x_0, y_0) is called

Elliptic if $B^2 - 4AC < 0$

Parabolic if $B^2 - 4AC = 0$

Hyperbolic if $B^2 - 4AC > 0$

In the problems of heat transfer, fluid stream issues and in soil moisture diffusion equation the variable W means a particular variable or specific dependent variable such as soil moisture, temperature, velocity in fluid problems, heat flow, current etc in flow problems

while studding various problems. Fractional calculus is rising field of research. Many issues of various fields are displayed with the assistance of nonlinear partial differential equation. Fractional calculus is a name for the theory of integrals and derivative of arbitrary order unified and generalized the integer- order differential and n-fold integration. Fractional calculus was started when a inquiry arise about the derivative to an integer order n and could be extended to still be valid when n is not an integer.

2) REVIEW OF LITERATURE :-

To get the approximate solution of partial differential equations, finite difference method are broadly used. To solve the differential equation means to find a function satisfying given relationship between its various derivatives on some given region of space or time along with same initial and boundary conditions. The finite difference methods are developed by many mathematicians in the last decade. Mostly Beresin and Chidkov (1965), Richtmeyer and Morton (1967), Roache (1976), Smith (1978), and tannehill and Pletcher (1984) the finite difference methods are successfully applied for solving linear and non-linear differential equations occurring in various fields. With development of finite difference methods for solving differential equations. This allow us to investigate order of accuracy of an approximation, stability of solution and convergence of the finite difference method. Finite difference method are easy to invent and can be broadly useful to two or three dimension problems and requires less computational work than other method like finite elements methods. With the development of new powerful computer algebra system (CAS) like MATLAB, MAPLE, MATHEMATICA, SAILAB etc has changed drastically the traditional concept of use of computers in various field of science as well as other fields.

3) OBJECTIVES:-

3.1) To study some mathematical models of various fields and classify it into Elliptic, Parabolic and Hyperbolic form.

3.2) To study and develop finite difference scheme for these models of remains fields.

3.3) To study the stability and convergence of solution of such models.

3.4) To study the theory of fractional calculus to develop finite difference methods such as explicit and implicit scheme.

3.5)By using new powerful computer algebra system like MATLAB, MAPLE, MATHEMATICA, SAILAB etc the solution of such models will be obtained and these solution are repres3nted graphically.

4) METHODOLOGY :-

4.1) To study the fractional calculus and some introductory concepts useful for work/study.

4.2) The methods like, iterative: variational iteration method and decomposition method for partial and partial fractional order differential equation will be discussed. Stability of variational iteration method will be discussed. An application of some example will be solved and solution will be represented graphically using mathematical software's.

4.3) Some linear and non-linear fractional partial differential equation will study and fractional order finite difference scheme will be discussed.

4.4) By applying finite difference scheme, stability of solution will be proved and convergence of the scheme will be shown.

4.5) Numerical solution will be obtained by using mathematical software's.

4.6) Explicit fractional order finite difference scheme for various models will be developed, stability and convergence of solution will be discussed/proved.

4.7) Implicit fractional order finite difference scheme for various models will be developed, stability and convergence of solution will be proved.

5) IMPORTANCE :-

5.1) International status :-In the recent year, fractional calculus has played a very importance role in various field based on the wide application in engineering and science such as Physics, Mechanics, Chemistry, Soil Physics and Biology. Research on fractional ordinary and partial differential equation and other relative topics is active and extensive around the world.

5.2) National status :- calculus is as old as three hundred plus years, so is fractional calculus. Fractional calculus is extension of the classical calculus, so is parallel with classical calculus. So study of fractional calculus in various field is importance.

5.3) Significance of the study :- Fractional calculus is at this stage an area where many models are applied to real world application in many field of science and engineering . Researcher have reported many results in several articles. But still large number of non-local

phenomenon unexplored and waiting to be discovered. Therefore there is a great scope to discover new aspects of the fractional modeling and applications in various fields of science and engineering.

6) PROPOSED WORK PLAN :-

6.1) First year :-

6.1.1) Review of literature will be done by visiting various libraries.

6.1.2) Course work will be completed.

6.2) Second year :-

6.2.1) Formulation of problem will be done and research paper in conference will be presented.

6.2.2) Some linear and non-linear fractional partial differential equation will study and fractional order finite difference scheme to be obtain.

6.2.3) Research paper will be communicated for publication.

6.3) Third year :-

6.3.1) Explicit/Implicit fractional order finite difference scheme for various models will be develop and research paper will be communicated.

6.3.2) At the end of third year or in fourth year final synopsis will be submitted.

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